TEACHERS' MANUAL FOR

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Exploring in Science

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TEACHERS' MANUAL FOR
Exploring in Science

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OUR
WORLD
OF
SCIENCE

Ginn and Company

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FOREWORD: OUR WORLD OF SCIENCE

"It is no longer possible for us to ignore science in the elementary school if we are to discharge our full responsibilities as teachers," a superintendent of schools said recently to his teachers. In these words he expressed the view of thousands of parents in the United States who have become convinced of the great power of science in this modern world.

Unquestionably teachers in the elementary schools wish to meet the growing demand for science. But many of them are hesitant about teaching science because they recognize a weakness in their own background. The basal books in the series OUR WORLD OF SCIENCE and the accompanying Manuals have been written to meet the needs of classroom teachers, whether they have had previous training in science or not. The program of science presented in this series is one in which teachers can learn science with their pupils.

Reasons for Teaching Science

A moment's reflection is sufficient to indicate that there is no part of the elementary-school curriculum that has more important contributions to make to the present and future welfare of the nation and of the world than has science. In the following paragraphs are discussed briefly a few of these contributions.

Science makes it possible to abolish poverty. Geologists have learned a great deal recently about how to explore the earth for basic material resources. In cases where raw materials for some substances are scarce, chemists have learned ways of making synthetics which will serve all the purposes required of the original substances. This is illustrated in the manufacture of synthetic tires and quinine, for example. Chemists strive to make new substances from raw materials that are found in abundance, such as clay, farm produce, and coal tar, thus providing new substances at a very low cost. In this way industry is promoted, more people are given employment, and the new materials are made available to increasing numbers of people. Will the children in our classrooms be prepared to utilize wisely the great material resources of the earth?

Science makes it possible for us to eliminate backbreaking toil. A few years ago most of the work of the world was done with muscular energy. Today we have learned to harness vast stores of energy to machines that may be operated by the pressing of a button. These laborsaving devices can be used in our homes, in factories, and on the farm. Tasks which took hours or days to accomplish can now be completed in a simple operation, and thus more hours are provided for recreation. Will our children be equipped to make intelligent adjustment to the vast supplies of energy and new laborsaving inventions which are daily being made available?

Science makes it increasingly possible to improve the health and safety of the peoples of the world. One of the tasks of the children in our classrooms will be to see that the discoveries of the scientist make a life of good health and freedom from accident available to all.

Science makes it possible for hunger to be abolished. Many authorities contend that an ample supply of food can be raised for all the people of the world by using the improved methods of agriculture which have been discovered in recent years. There is, however, a grave danger that humanity will face increasing periods of famine if it does not soon learn to save its great soil resources. Will our children have the vision to plan for an ample world food supply, or will they through ignorance cause new periods of famine?

Everywhere we turn we see science offering to humanity a higher standard of living in the form of improved food supply, recreation, transportation, communication, and health for all. This improvement, secured on a world-wide basis, would eliminate the chief causes of rivalry between nations and would help to promote permanent world peace.

The United States, as a result of recent events, has assumed a unique responsibility for world leadership. American children must be encouraged to have high ideals of service to humanity, and they must know how to put their ideals into operation on a democratic basis. They must be made to realize the responsibilities and opportunities that are theirs because they are Americans. They must discover while they are young the importance of science and must learn how it can be used to promote world welfare.

The record of the past indicates many fatal errors. Depressions, wars, destruction of valuable soils, pollution of streams and waterways, wastage of mineral resources, introduction of crop pests, have left their mark. With them have come needless poverty and ill health. The elementary school today is responsible for the development of a generation that will be wiser than past generations. Children must learn to realize the power that man has secured through science for the development of a civilization superior to their own.

The task, then, of the elementary teacher in teaching science is clear. Failure on her part to open up the avenues of science to the natural drives of children may result in citizens of tomorrow who are poorly prepared for the adjustments and responsibilities of the atomic age.

The Use of Books in the Teaching of Science

As much as possible the teacher should work with the children while they work, read with them while they read, discuss matters when they discuss them. In other words, the teacher should be a member of the group, learning with the children in a natural situation instead of watching their activities as a bystander or outsider. In all this work the basal book in science can lead to dynamic motivation and vitality of instruction.

The Development of an Informal Working Situation. An informal working situation in teaching science brings good results. It provides an opportunity for children to express their own ideas and to develop lines of interest.

This need not be interpreted, however, as a loose and undisciplined procedure. Science in itself has its discipline, which grows out of the scientific method and attitudes, and the teacher[1] should be keenly aware of the relation of method and attitudes to desirable social behavior in children. If this awareness is applied in science teaching, the teachers of a school should discover, in the work from the first grade through the eighth, a marked improvement in the ability of children to work together on problems.

In the teaching of science both teacher and children should feel relaxed. Much of the austerity found in American classrooms grows out of pressure and haste, which are not in keeping with the rhythm and tempo of child life. If the teacher will remember that the very nature of science calls for discovery and open-mindedness, she will lose the fear of admitting an error in her own thinking. She need have no reluctance in stating frankly that she is learning with her pupils and that there are many things she does not know. The true scientist is learning when he is making discoveries.

Reading in Science Teaching. Reading in the science book should lead to other types of activities, such as discussion, performing an experiment, and planning a science excursion. These activities in turn will cause the children and teacher to go back to the basal book or to supplementary material for information and for new interests and subjects. Many teachers find oral reading useful in science teaching.

As much time as is needed should be taken to clear up each thought. The teacher should allow the child to work important ideas found in the basal books into his thinking through the use of such basic drives as curiosity, imagination, and manipulation. The use of children's natural drives need not place the teacher in an embarrassing position, since in an informal teaching situation children can help one another.

It should be noted that this kind of work does not call for rapid reading. In fact, it may mean slow reading, with much

[1] Gerald S. Craig, *Science for the Elementary-School Teacher*, pp. 13–19, 30–36. Ginn and Company, Boston, 1940.

4. Metals are minerals. Someone may wish to find out about common metals and report to the group.

5. Write stories which give the history of a certain kind of rock. Titles might be as follows: "How Quartz Is Formed," "How Granite Turns to Gneiss."

6. There are fascinating stories about famous precious stones. The Hope blue-diamond story would interest children.

Ways to Evaluate Learnings. Sometimes you will evaluate learnings by such questions as the following, which may be written or discussed:

1. To what degree does this study help children to realize the age of the earth and changes that have gone on since it was formed?
2. What does a fossil tell your children about the history of the earth?
3. How interested are your children to continue on their own a search for new rocks and mineral samples and find the history story behind them?
4. To what extent can children talk about this experience with facts behind their statements?
5. What evidences do you have that children have grown in the use of the scientific method at any point in this study?
6. To what extent have children learned to use the tools of research to find answers to their questions?

IMPORTANT SCIENCE WORDS IN THIS CHAPTER

conglomerate (kŏn glŏm′ẽr ĭt). Pudding stone, a rock made of sand and pebbles.
fossil (fŏs′ĭl). Remains or impression of a prehistoric animal or plant.
gneiss (nīs). A metamorphic rock, consisting of feldspar, mica, and quartz.
mica (mī′kȧ). A mineral, sometimes called isinglass, that shines and peels off in layers.
schist (shĭst). A metamorphic crystalline rock, easily split into sheets.

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Loomis, F. B. *Field Book of Common Rocks and Minerals*. Putnam, 1923.

For the Children

Buckingham, B. R., ed. *The Elephant's Friend*, pp. 31–35, "The Coal V Burn." Ginn, 1936.
Buckingham, B. R., ed. *In a Green Valley*, pp. 265–277, "Talc." Ginn, 193
Fenton, Carroll L. *Along the Hill.* Putnam, 1935.
Janssen, Raymond E. *Buried Sunlight.* Row, 1941.
Petersham, Maud and Miska. *The Story Book of Earth's Treasures.* Wi ston, 1935.
Robinson, W. W. and Irene. *Beasts of the Tar Pits.* Macmillan, 1932.
Rugg, Harold, and Krueger, Louise. *First Book of the Earth*, pp. 160–17 194–196, 216–222, 230–235. Ginn, 1936.
Washburne, C. W. and H. C. *The Story of Earth and Sky*, pp. 317–33 Appleton, 1933.
Writers' Program, Pennsylvania. *The Book of Stones.* Whitman, 1939.

FILM

Earth's Rocky Crust

XII. CONSERVATION

he last few years have brought forcefully to our attention the that America is a wasteful nation. The salvage program of Second World War did much to make us conscious of the l to conserve for wartime.

uring the entire history of America most people have given e thought to conservation problems. Forests have been slashed. has been depleted. Grasslands have been overgrazed. Clear, kling streams have been polluted so that fish no longer abound iem.

OSES OF THIS CHAPTER

o help children to appreciate that America is rich in natural urces

o enlist children's co-operation in the conservation of our it natural resources

o acquaint children with the vast waste of natural resources e has been in America

o help children to understand that *conserve* means "use ely"

To point out the ways in which America can correct past errors

AT THE TEACHER NEEDS TO KNOW

The stories in the chapter give the facts you need to know. u will learn what America was like when the white man came ive here. The stories deal with our use and misuse of its great ural resources. These resources include good soil, forests, sslands, animal life, and minerals, including coal and oil. Some mers are guilty of wasting much good soil by poor farming thods. Lumbermen and pioneers wastefully cut down forests. ctory wastes pollute streams. Damaging floods result because ests have disappeared.

Good soil is an invaluable resource. It takes years to make od soil.

Farmers today know more about ways to save the s National-conservation groups are carrying on reforestation p grams. Forest rangers are ever watching for signs of forest fi People today are awakening to the need of co-operative conser tion measures.

WAYS IN WHICH THE TEACHER MIGHT PROCEED

The stories in this chapter might well be real aloud one a time. Pause often for comments and questions. The histori nature of the treatment of conservation here would bring to m such questions for discussion as the following:

Why did not the early people realize the need for conservatic

When did the need to conserve resources begin to dawn up our people?

What measures have been taken to prevent waste of natu resources?

How did slashing the forests increase the danger of floods?

In what ways can governments help in conservation measure

How can you help each day right at school and at home?

Can You Find Out? (p. 304) 1. By depositing rich silt over t land every year at flood time, the Nile refreshes the soil.

2. It is better to have a committee write one letter than to flo the United States Forest Service in Washington with mail.

3. In the early days of North America the relatively few col nists cut down only a comparatively small number of trees clear the land for farming and to supply timber for their home Today great lumbering companies cut down vast numbers of tre each year to supply the huge demand of our enormous populatio

4. Cutting thousands of Christmas trees yearly does no har as long as an equal number of the trees is planted each year t take the place of those cut. The conservation programs of th state and national governments protect our forests, including th evergreens. The time for each tree to grow big can be ascertaine in encyclopedias.

5. Answers will vary.

Additional Activities. 1. Write to the Audubon Society for inormation about birds you should protect.

2. Write to your state game commission for hunting and fishing aws.

3. Take walks to discover evidences of damage by erosion or loods.

4. Ask the county farm agent, or the 4H Club leader, or a orest ranger to come to your school and talk about conservation.

Ways to Evaluate Learnings. The following questions to consider in class discussions will be helpful in evaluating learnings:

How do lumbering practices today differ from lumbering practices in the early colonial days of America's history?

Why did the pioneers who opened up the West and those who followed destroy so much timber?

To what extent can we blame the pioneers for their mistakes?

What measures are farmers taking to save their soil?

What measures are lumbermen taking to save the forests?

In how many ways are you helping to conserve natural resources?

IMPORTANT SCIENCE WORDS IN THIS CHAPTER

conservation (kŏn sẽr vā'sh*ŭ*n). Saving resources by wise use.
erosion (ē rō'zh*ŭ*n). Wearing away of soil by wind and water.
levee (lĕv'ē). An embankment to prevent floods.
reforestation (rē fŏr ĕs tā'sh*ŭ*n). Restoring forests by planting trees.
resources (rē sōrs'ĕs). Natural resources are the natural wealth of the land.

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Horn, Ernest, and others. *Following New Trails*, pp. 179–187, "Save Ou Forests." Ginn, 1940.
LeMay, Geraldine. *The Story of a Dam*. Longmans, 1940.
Sauer, Carol O. *Man in Nature*. Scribner, 1939.
Sears, Paul B., and others. *This Useful World*. Scott, 1942.

FILMS

Conservation of Natural Resources
Wearing Away of the Land
Work of Running Water
Work of Rivers*

*Films so designated are somewhat advanced in comparison with the text, bu may be useful for some groups.

APPENDIX

Equipment for *Exploring in Science*

The equipment here suggested can be secured by you and
our children in almost any community. It is well to set aside
science cabinet or cupboard or shelf to house these materials.
et the children help you collect equipment.

quarium
alloons
arometer
ell wire
ottles (nursing bottles)
andles
anned heat (alcohol)
ompass
orks
ry cells
ectric bell or buzzer
ectric plate
Electric switch
Flashlight
Glass funnel
Glass tubing
Globe
Hammer
Hand lens
Insect cage
Magnets
Medicine dropper
Microscope
Milk bottles
Plant jars
Rock samples
Rubber stoppers
Rubber tubing
Saucers
Shallow pans
Sterno stove
Thermometer (Fahrenheit)
Tin cans
Window glass
World map

Scientific Supply Houses

The addresses of several scientific supply houses are given be-
w. Most firms will furnish a catalogue to a school when someone
authority requests it.

Cambosco Scientific Company, 37 Antwerp Street, Brighton Station, Boston,
assachusetts; Central Scientific Company, 1700 Irving Park Boulevard, Chi-
go, Illinois; 79 Amherst Street, Cambridge 39, Massachusetts; Chicago
pparatus Company, 1735–1740 North Ashland Avenue, Chicago, Illinois;
imer and Amend, 633 Greenwich Street, New York City, New York; Fisher
ientific Company, 709–719 Forbes Street, Pittsburgh, Pennsylvania.

List of Publishers

PPLETON, D. Appleton-Century Company, Inc., 35 West 32d St., New York.
OBBS. Bobbs-Merrill Company, 724 N. Meridian St., Indianapolis 7, Ind.
ODD. Dodd, Mead & Company, Inc., 449 Fourth Ave., New York 10, N. Y.
OUBLEDAY. Doubleday, Doran & Company, Inc., 14 West 49th St., New York 18, N. Y.
UTTON. E. P. Dutton & Co., Inc., 300 Fourth Ave., New York 10, N. Y.
OLLETT. Follett Publishing Company, 1255 S. Wabash Ave., Chicago 5, Ill.

Ginn. Ginn and Company, Statler Building, Park Square, Boston 17, Mass.
Hale. Ralph T. Hale & Company, 3 Joy St., Boston 8, Mass.
Harcourt. Harcourt, Brace and Company, 383 Madison Ave., New York.
Harper. Harper & Brothers, 49 East 33d St., New York, N. Y.
Heath. D. C. Heath & Company, 285 Columbus Ave., Boston, Mass.
Holt. Henry Holt and Company, Inc., 257 Fourth Ave., New York 10, N. Y.
Houghton. Houghton Mifflin Company, 2 Park St., Boston, Mass.
Knopf. Alfred A. Knopf, Inc., 501 Madison Ave., New York 22, N. Y.
Lippincott. J. B. Lippincott Company, 227–231 S. 6th St., Philadelphia 5, Pa.
Little. Little, Brown and Company, 34 Beacon St., Boston 6, Mass.
Longmans. Longmans, Green & Co. 114 Fifth Ave., New York 11, N. Y.
Lyons. Lyons & Carnahan, 2500 Prairie Ave., Chicago 16, Ill.
McClurg. A. C. McClurg & Company, 333 E. Ontario St., Chicago, Ill.
Macmillan. The Macmillan Company, 60 Fifth Ave., New York 3, N. Y.
Oxford. Oxford University Press, 114 Fifth Ave., New York 11, N. Y.
Putnam. G. P. Putnam's Sons, 2 West 45th St., New York 11, N. Y.
Rand. Rand McNally & Company, 536 S. Clark St., Chicago 5, Ill.
Reynal. Reynal & Hitchcock, 8 West 40th St., New York 18, N. Y.
Row. Row, Peterson & Co., 1911 Ridge Ave., Evanston, Ill.
Scott. Scott, Foresman and Company, 623–633 S. Wabash Ave., Chicago 5, Ill.
Scribner. Charles Scribner's Sons, 597 Fifth Ave., New York 18, N. Y.
Stokes. Frederick A. Stokes Company, 227–231 S. 6th St., Philadelphia 5, Pa.
Teachers College, Columbia. Teachers College, Columbia University, 525 West 120th St., New York 27, N. Y.
University of Oklahoma. University of Oklahoma Press, Norman, Okla.
Viking. The Viking Press, Inc., 18 East 48th St., New York 17, N. Y.
Whitman. Whitman Publishing Company, 1220 Mound Ave., Racine, Wis.
Wiley. John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.
Winston. The John C. Winston Company, 1006–1016 Arch St., Philadelphia 7, Pa.

Films

The films mentioned in this Manual are produced and distributed by Encyclopaedia Britannica Films, Inc., 20 N. Wacker Drive, Chicago, Illinois. Other educational films are listed, with brief descriptions, in a monthly cumulated catalogue, *Educational Film Guide*, compiled by Dorothy E. Cook and Eva Rahbek-Smith and published by The H. W. Wilson Company, 950–972 University Avenue, New York 52, N. Y.

There is of course a considerable range in the effectiveness of films, and no film should be used in the classroom on the basis of title or brief description only. The teacher should become familiar with the content of the film.

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